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FLOOD INSURANCE STUDY

TOWN OF PERRYVILLE, MARYLAND
CECIL COUNTY

REVISED
MARCH 5, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 240024

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Flood Insurance Study Effective Date: March 1, 1977

Flood Insurance Study Revised: March 5, 1990

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FLOOD INSURANCE STUDY
TOWN OF PERRYVILLE, CECIL COUNTY, MARYLAND

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Study/Flood Insurance Rate Map for the Town of Perryville, Cecil County, Maryland. This information will be used by the Town of Perryville to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses prepared by the Susquehanna River Basin Commission (SRBC) for the Federal Emergency Management Agency (FEMA), under Contract No. H-3496. In this revision, the hydrologic and hydraulic analyses for Mill Creek were prepared by the Baltimore District of the U. S. Army Corps of Engineers (COE) for FEMA, under Inter-Agency Agreement No. EMW-87-E-2549, Task Letter No. 87-7. The work for this revised study was completed in July 1988.

1.3 Coordination

A consultation and coordination meeting was held with town officials to present the findings of the original study. Flood discharge and tidal data were coordinated with the COE, the U. S. Geological Survey (USGS), and the National Ocean Survey.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Perryville, Cecil County, Maryland. The area of study is shown on the Vicinity Map (Figure 1).

The Susquehanna River and Mill Creek were studied by detailed methods for their entire lengths within the community. This revision incorporates detailed hydrologic and hydraulic analyses for Mill Creek. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

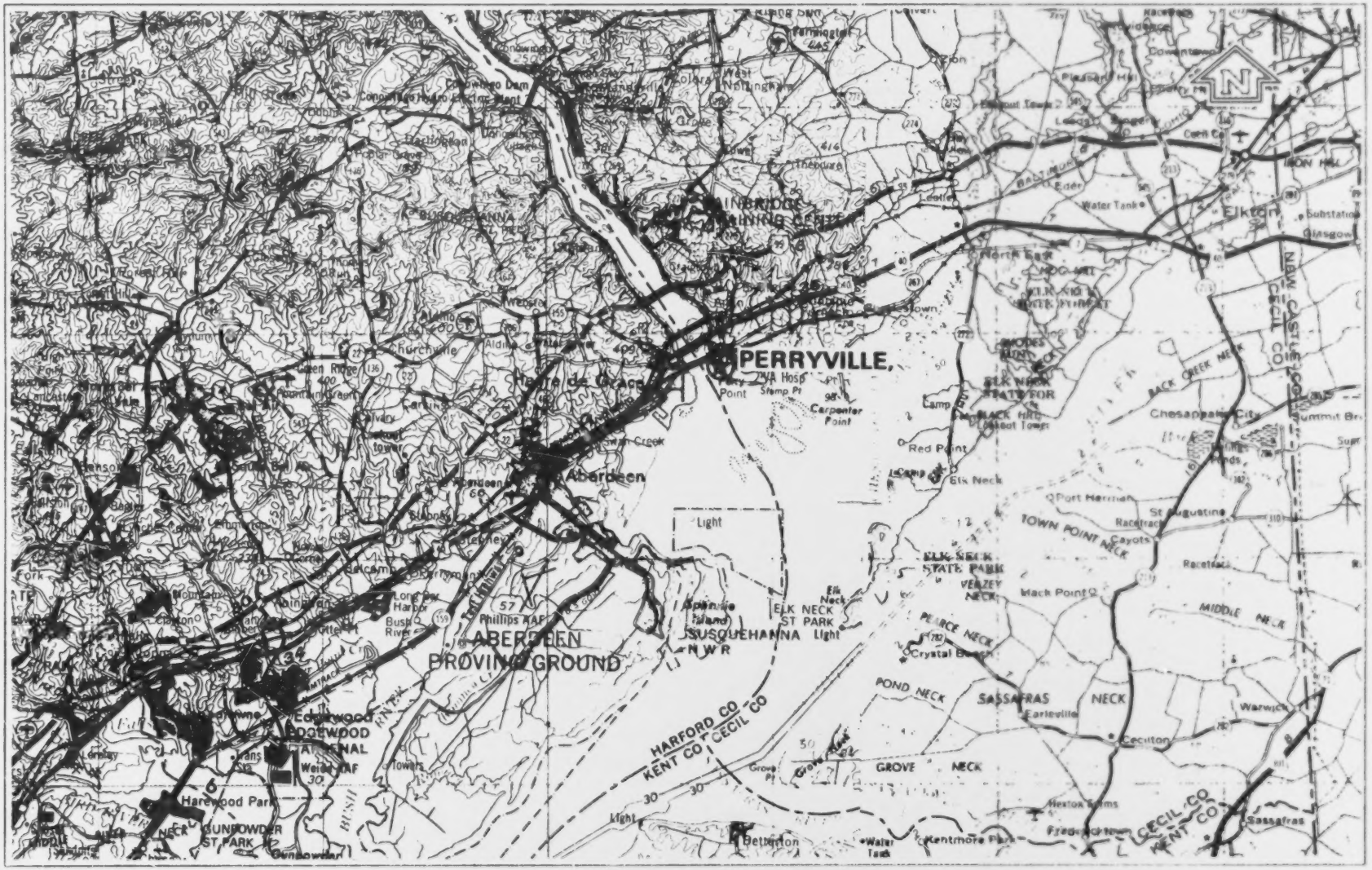
2.2 Community Description

The Town of Perryville is located in Cecil County in eastern Maryland, approximately 1 mile upstream of the confluence of the Susquehanna River and the Chesapeake Bay. It is completely surrounded by the unincorporated areas of Cecil County. The 1970 population of the town was 2,091; this figure represents an increase of 210.2 percent over the 1960 population. The rapid increase in population was due to the annexation of adjacent areas. The town has a land area of 1.59 square miles.

The Susquehanna River flows south by the town, forming its western boundary. Garrett Island lies directly opposite of Perryville, and splits the flow of the river; the island and the river form the boundary between Cecil and Harford Counties. The Town of Havre de Grace, a community of approximately 10,000 persons, is located across the river. Perry Point lies to the south of Perryville. Because of its proximity to the Chesapeake Bay, the town experiences tidal flooding from the bay caused by storm surge. Downstream of and within Perryville, water-surface elevations on the Susquehanna River are dominated by tidal elevations of the Chesapeake Bay. This tidal influence on flooding continues upstream to a point approximately at the CONRAIL bridge. These tidal elevations also affect a small section in the northeastern part of Perryville, near the mouth of Mill Creek.

Mill Creek and its tributaries drain the relatively undeveloped northern and eastern portions of the town. Additional runoff flows through natural and man-made drains into the Susquehanna River. Development along the river mainly consists of marine and recreational facilities.

The climate of the area is generally continental, but is modified by effects of the Atlantic Ocean and the Gulf of Mexico.


PERRYVILLE
Aberdeen
Havre de Grace
ABERDEEN PROVING GROUND
Phillips AAF
ELK NECK ST PARK
SUSQUEHANNA NWR
Light
Elkton
Chesapeake City
Edgewood
EDGEWOOD ARSENAL
Harewood Park
GUNPOWDER ST PARK
Betterton
Cecilton
Warwick
Earleville
Sassafras
Carpenter Point
Red Point
Elk Neck
Turkey Point
Stump Pt
Mack Point
Crystal Beach
Spesutie Island
Bush River
Gunpowder
Water Tank
Kentmore Park
Hexton Farms
Fredericktown
Grove Point
Grove Neck
Pond Neck
Sassafras Neck
Pierce Neck
Vezzey Neck
Town Point Neck
Elk Neck State Park
Back Creek Neck
Middle Neck
Iron Hill
Glasgow
Summit Br
St Augustine
Racetrack
Port Herman
Cayots
Conowingo Dam
Conowingo Hydro Electric Plant
Conowingo Pond
Susquehanna River
Susquehanna Flats
Chesapeake Bay
Elk River
Bohemia River
Back River
Gunpowder River
Bush River
Aberdeen Creek
Swan Creek
Long Green Creek
Romney Creek
Winters Run
Deer Creek
Broad Creek
Broad Creek
Mill Creek
Mill Creek
Mill

2.3 Principal Flood Problems

Historic data and information from this study indicate that the Susquehanna River is the principal source of flood problems in Perryville. The 100-year floodplain of the Susquehanna River within the town includes a narrow strip of land along the river's edge, which is undeveloped except for a number of marina facilities.

2.4 Flood Protection Measures

There are no existing or proposed flood protection projects in the Town of Perryville. However, a number of upstream dams contribute to the reduction of flood hazards from the Susquehanna River.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency and peak elevation-frequency relationships for each flooding source studied in detail affecting the community.

Flood discharges and profile starting elevations for the Susquehanna River were determined by the SRBC.

Flood frequency-discharge values for the Susquehanna River were obtained from the Discharge Frequency Curves for the stream gages at Harrisburg and Sunbury, as published by the COE. Records have been kept at the Harrisburg gage since 1928, and at the Sunbury gage

since 1938. The 10-, 50-, 100- and 500-year discharge values at the gaging stations were plotted against drainage area on log-log paper and the curve was extrapolated to the drainage area at the mouth of the Susquehanna River.

In this revision, the flood frequency-discharge value for Mill Creek was obtained from the Flood Insurance Study for the unincorporated areas of Cecil County (Reference 1).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SUSQUEHANNA RIVER At confluence with Chesapeake Bay	27,500	460,000	680,000	780,000	1,200,000
MILL CREEK At confluence with Furnace Bay	3.8	*	*	3,340	*

*Data not computed

Tidal data for a 2-year period of record at the Havre de Grace tide gage was extended by cross-correlation with the 70 years of tidal data available at Baltimore, and through the use of a synthetic series of annual maximum tides computed for Havre de Grace. This annual series was then analyzed in accordance with procedures recommended by the Water Resources Council for the analysis of annual series of stream flow data (Reference 2).

The stillwater elevations for the 10-, 50-, 100-, 500-year floods have been determined for the Susquehanna River and Mill Creek and are summarized in Table 2, "Summary of Stillwater Elevations."

TABLE 2 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CHESAPEAKE BAY At confluence of Susquehanna River	5.5	6.9	7.5	8.9
MILL CREEK At confluence with Furnace Bay	*	*	12.0	*

*Data not computed

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the Susquehanna River were located at regular intervals and at significant changes in ground relief, land use, or land cover. A total of 6 cross sections were used to analyze the river through Perryville. Ground elevations for the cross sections were obtained photogrammetrically as the base maps, at a scale of 1:2,400, were compiled. The channel-bottom elevations for the river were obtained from existing profiles. In this revision, cross sections for the backwater analysis of Mill Creek were obtained from field surveys conducted in December 1987. Elevation data and structural geometry for all bridges, culverts, and other hydraulic structures were also obtained from field surveys.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 3). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations were assumed for the Susquehanna River at the first river section, located approximately 0.5 mile downstream of Perryville; the assumed elevations were based on the tidal analysis. In this revision, the starting water-surface elevation used at the downstream limit of detailed study on Mill Creek was taken from the Flood Insurance Study for the unincorporated areas of Cecil County (Reference 1).

Channel roughness factors (Manning's "n") used in the hydraulic computations for the Susquehanna River were assigned on the basis of aerial and ground-level photographs, topographic maps, field inspections, channel and overbank conditions, and reference works by Chow and the Bureau of Public Roads (References 4 and 5). For the Susquehanna River within the Town of Perryville, the channel "n" value was 0.030 and the overbank "n" values ranged from 0.060 to 0.065. In this revision, channel roughness factors for Mill Creek were assigned on the basis of field observation of the stream and floodplain areas. Channel "n" values for Mill Creek ranged from 0.012 to 0.045, and overbank "n" values ranged from 0.045 to 0.075.

In the original study, the hydraulic model was tested and the "n" values adjusted within an acceptable range to best fit known high-water marks and/or elevations at gaging stations for the Susquehanna

River from its mouth to the Conowingo Dam. All gaging station elevations were determined by the SRBC, on the basis of established rating curves. High-water marks obtained by the USGS for the June 1972 flood were used. The 1972 flood had a recurrence interval of approximately 400 years on the Susquehanna River; the 1972 maximum tide elevation on the Chesapeake Bay had a recurrence interval of approximately 100 years.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

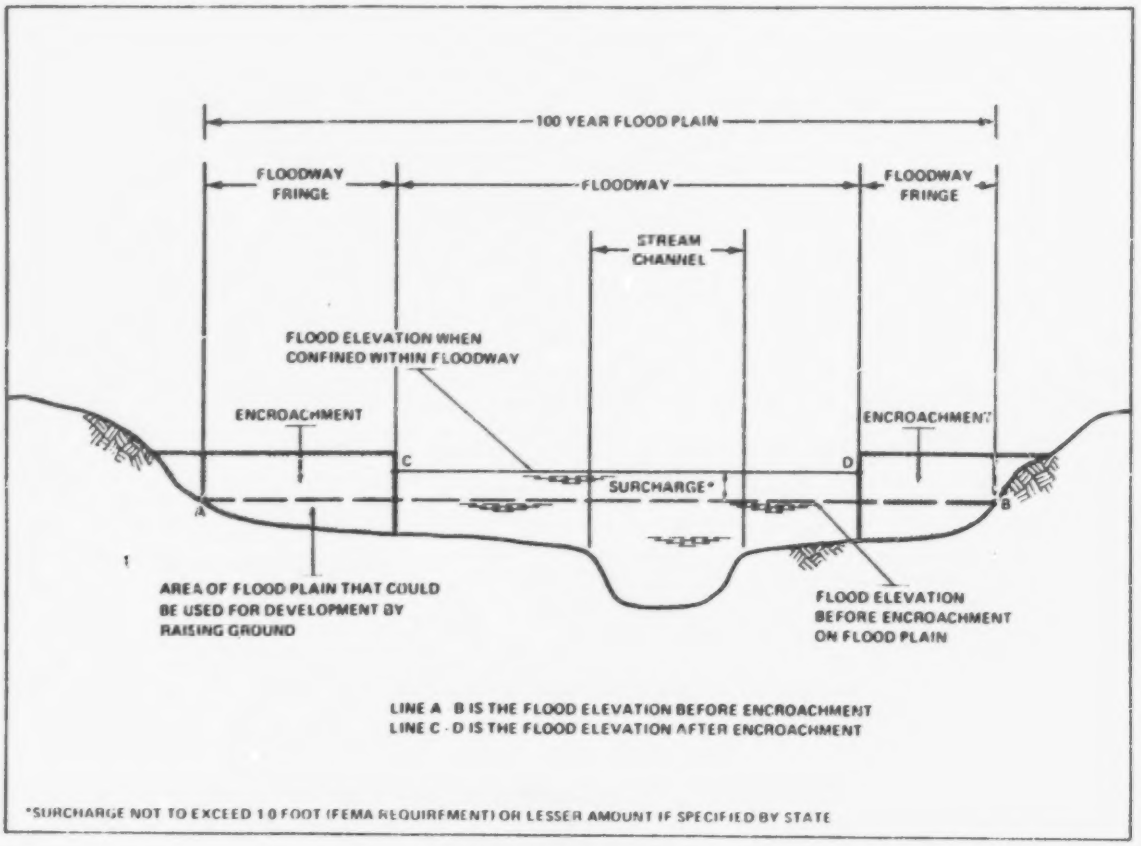
To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries for the Susquehanna River were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet. In this revision, the 100-year floodplain boundaries for Mill Creek were delineated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 6).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

No floodways were calculated for this study. In the case of the Susquehanna River, the concept of a floodway is not applicable because flooding from the Susquehanna River within Perryville is dominated by the tidal influence of the Chesapeake Bay. Because of the scope of this revision, no floodway was calculated for Mill Creek.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

7.0 OTHER STUDIES

A Flood Insurance Study has been prepared for the unincorporated areas of Cecil County (Reference 1). The results of this study are in agreement with the results of that study; however, due to annexations of land by the Town of Perryville, the corporate limits delineated for this study do not agree exactly with those in the Cecil County study.

Because it is based on more up-to-date analyses, this study supersedes the previously-printed Flood Insurance Study for the Town of Perryville (Reference 7).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Cecil County, Maryland, Washington, D. C., December 4, 1986.

2. Water Resources Council, "A Uniform Technique for Determining Flood Flow Frequency," Bulletin 15, Washington, D. C., December 1967.

3. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, April 1984.

4. Ven Te Chow, Open-Channel Hydraulics, New York, McGraw-Hill, 1959.

5. U. S. Department of Commerce, Hydraulic Design Series No. 3, Design Charts for Open-Channel Flow, 1961.

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Havre de Grace, Maryland, 1953, Photorevised 1985.

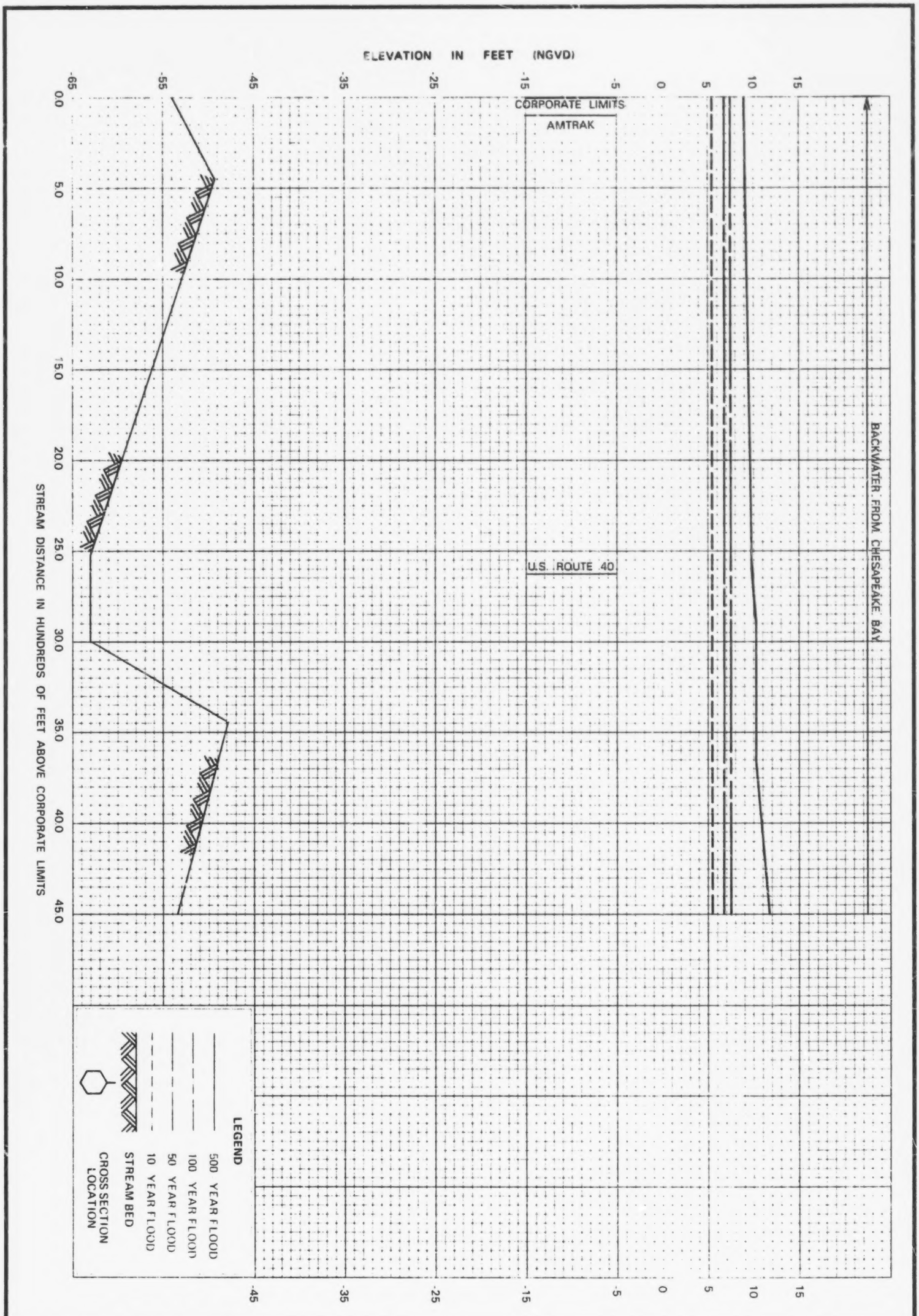
7. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Town of Perryville, Cecil County, Maryland, Washington, D. C., March 1, 1977.

U. S. Army Corps of Engineers, North Atlantic Division, Hydrologic Study Tropical Storm Agnes, Report No. 2, New York, October 1972.

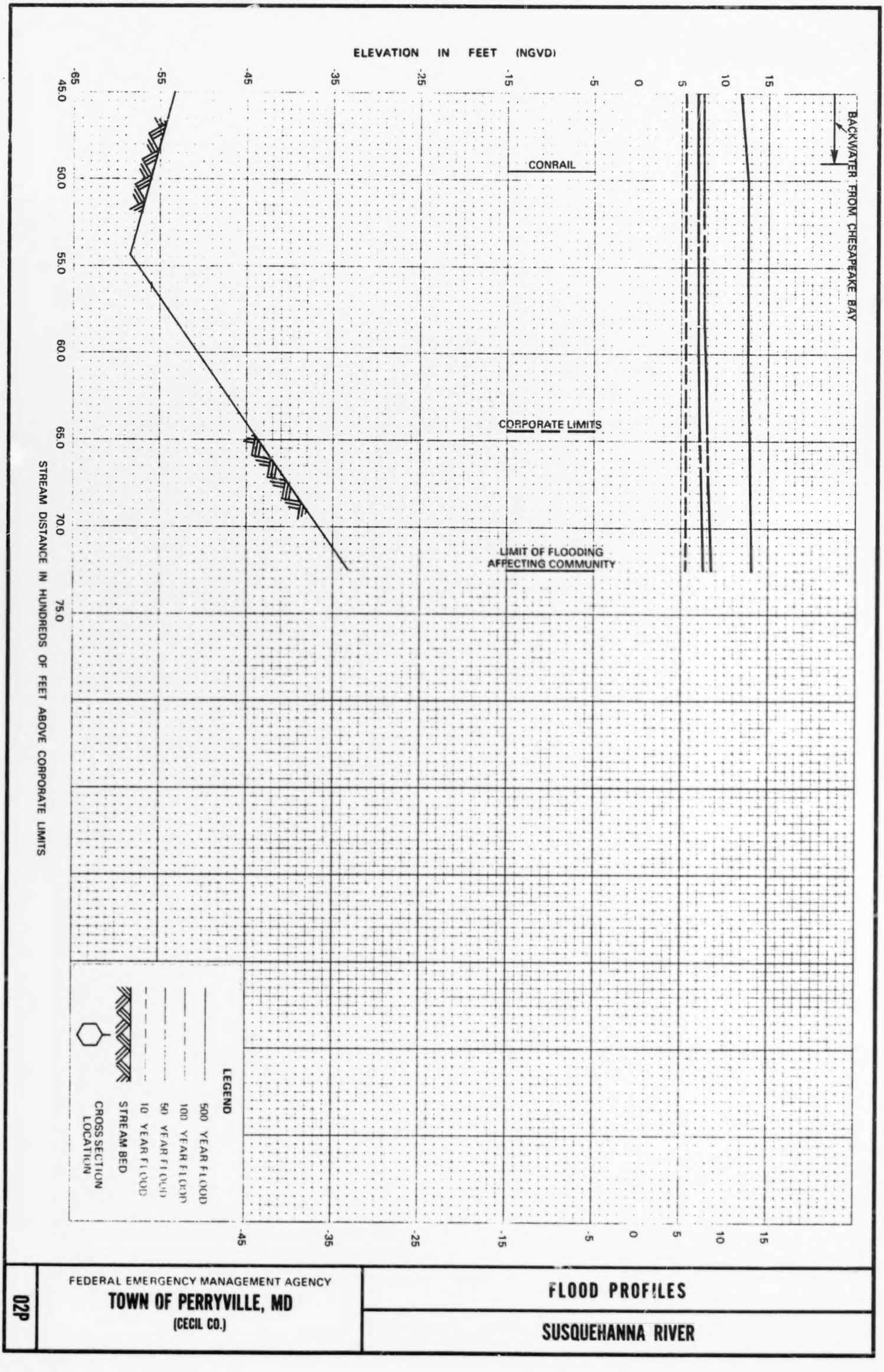
U. S. Army Corps of Engineers, North Atlantic Division, Hydrologic Study Tropical Storm Agnes (draft), New York, November 1973.

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	102.62	X cut in top of northwest corner of concrete culvert at US Route 40 crossing over Mill Creek, approximately 3.5 feet below level of road.
RM 2	48.60	X cut in top of northeast end of concrete rail of bridge abutment, at State Route 7 crossing of Mill Creek, approximately 2.6 feet above road.
RM 3	40.28	X cut in top corner of third step from bottom of northeast wing wall of abutment of Amtrak bridge over Mill Creek.
RM 4	44.87	X cut in top corner of north end of west abutment of Gravel Road bridge over Mill Creek, south of Amtrak bridge.



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWN OF PERRYVILLE, MD** (CECIL CO.)	**FLOOD PROFILES** **SUSQUEHANNA RIVER**



FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PERRYVILLE, MD

(CECIL CO.)

FLOOD PROFILES

SUSQUEHANNA RIVER

02P

BACKWATER FROM CHESAPEAKE BAY

CONFLUENCE WITH FURNACE BAY

CORPORATE LIMITS

ELEVATION IN FEET (NGVD)

20
10
0
-10

0 2 4 6 8 10 12 14 16 18 20 22 24 26

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH FURNACE BAY

100 YEAR FLOOD

STREAM BED

CROSS SECTION LOCATION

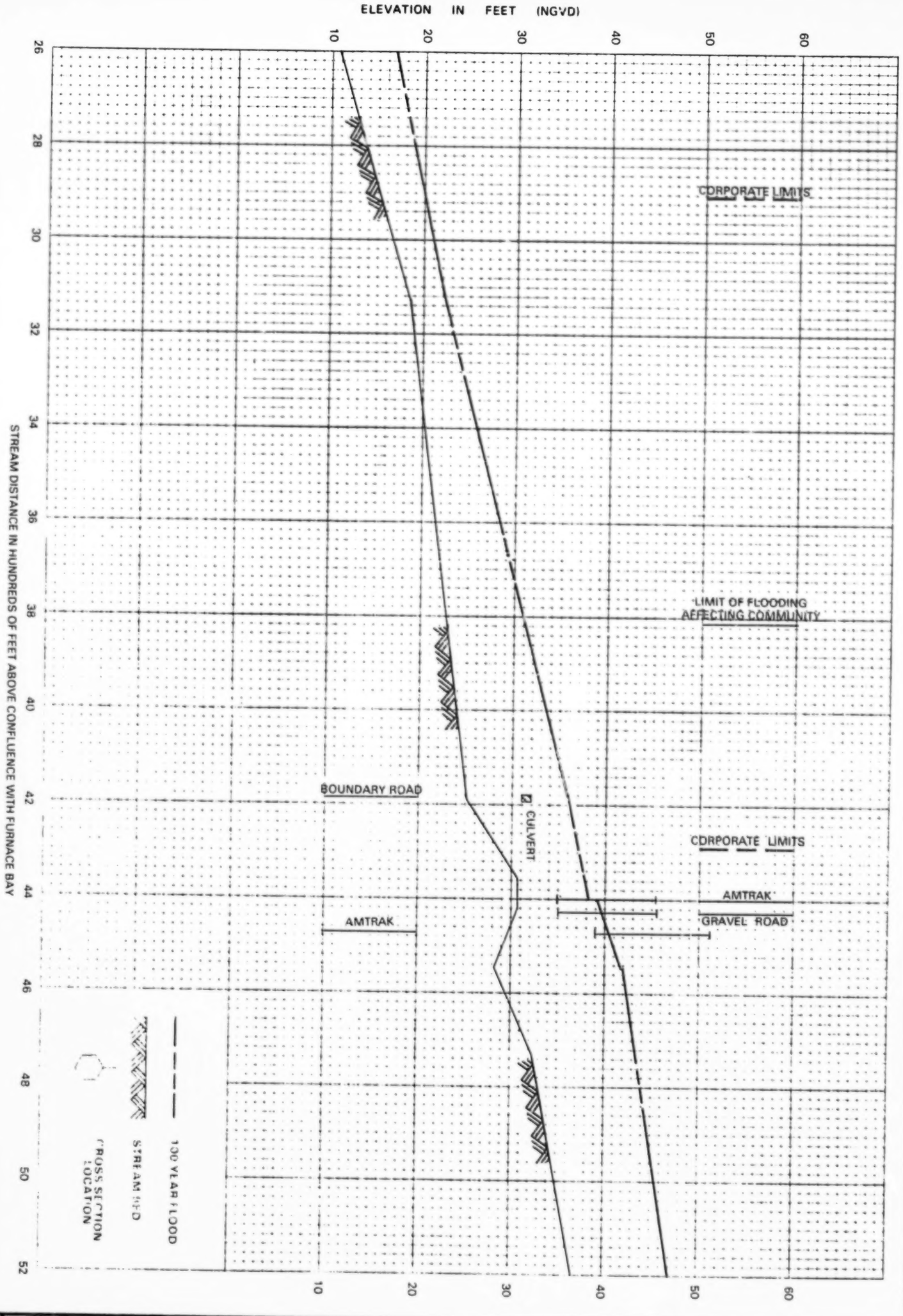
FLOOD PROFILES

MILL CREEK

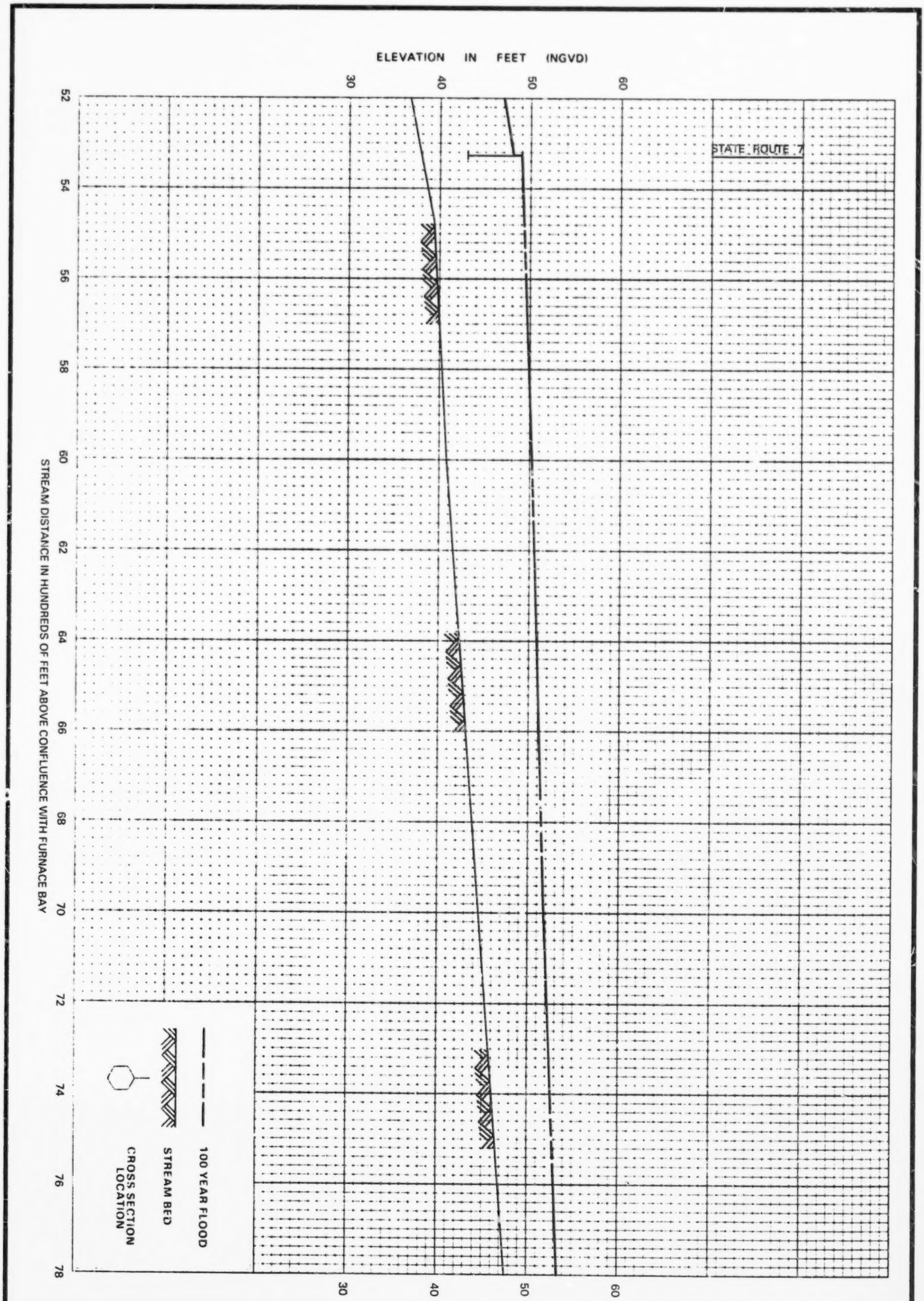
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PERRYVILLE, MD
(CECIL CO.)

03P



04P	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF PERRYVILLE, MD (CECIL CO.)	FLOOD PROFILES MILL CREEK



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05P

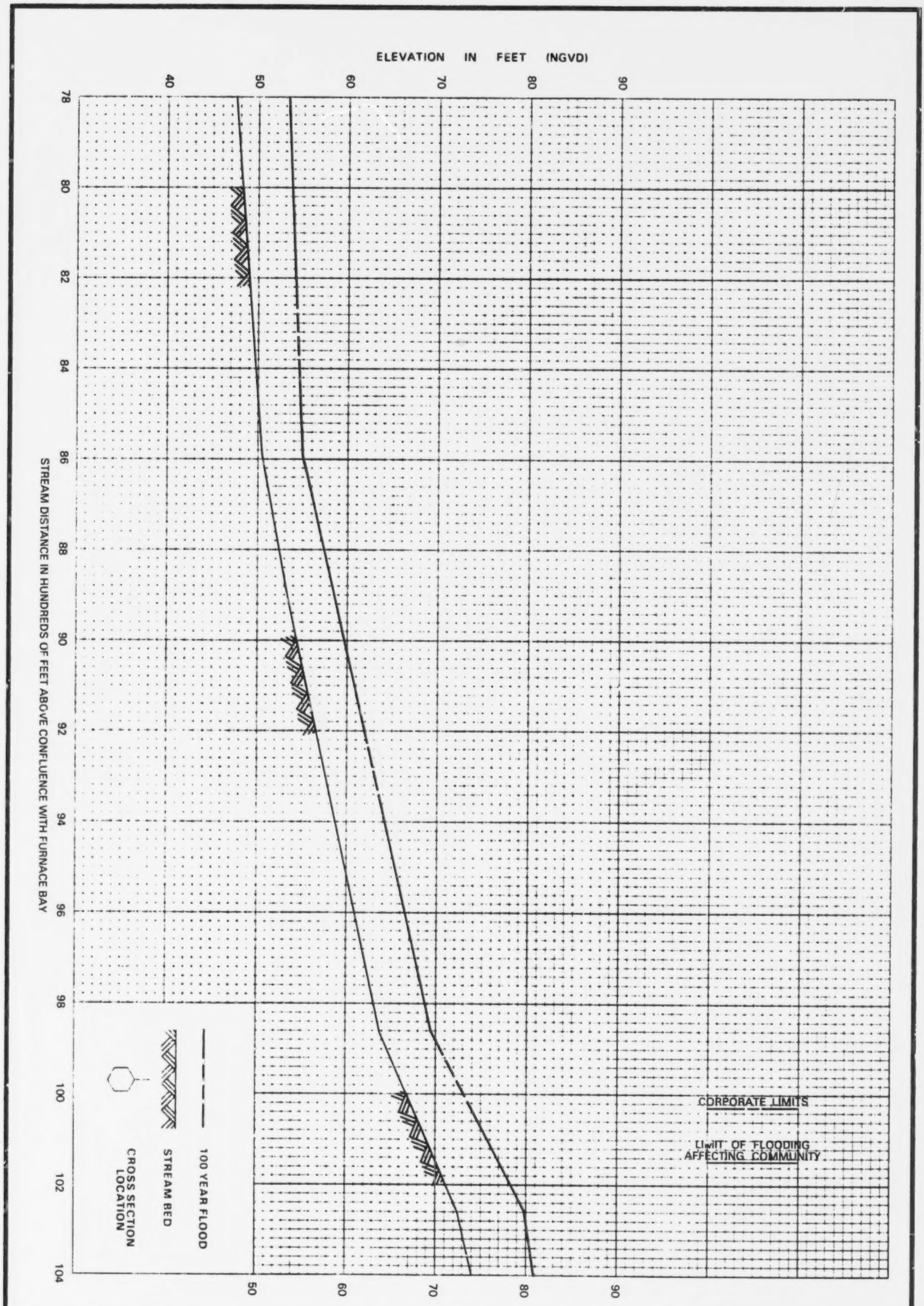
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PERRYVILLE, MD

(CECIL CO.)

FLOOD PROFILES

MILL CREEK



FEDERAL EMERGENCY MANAGEMENT AGENCY

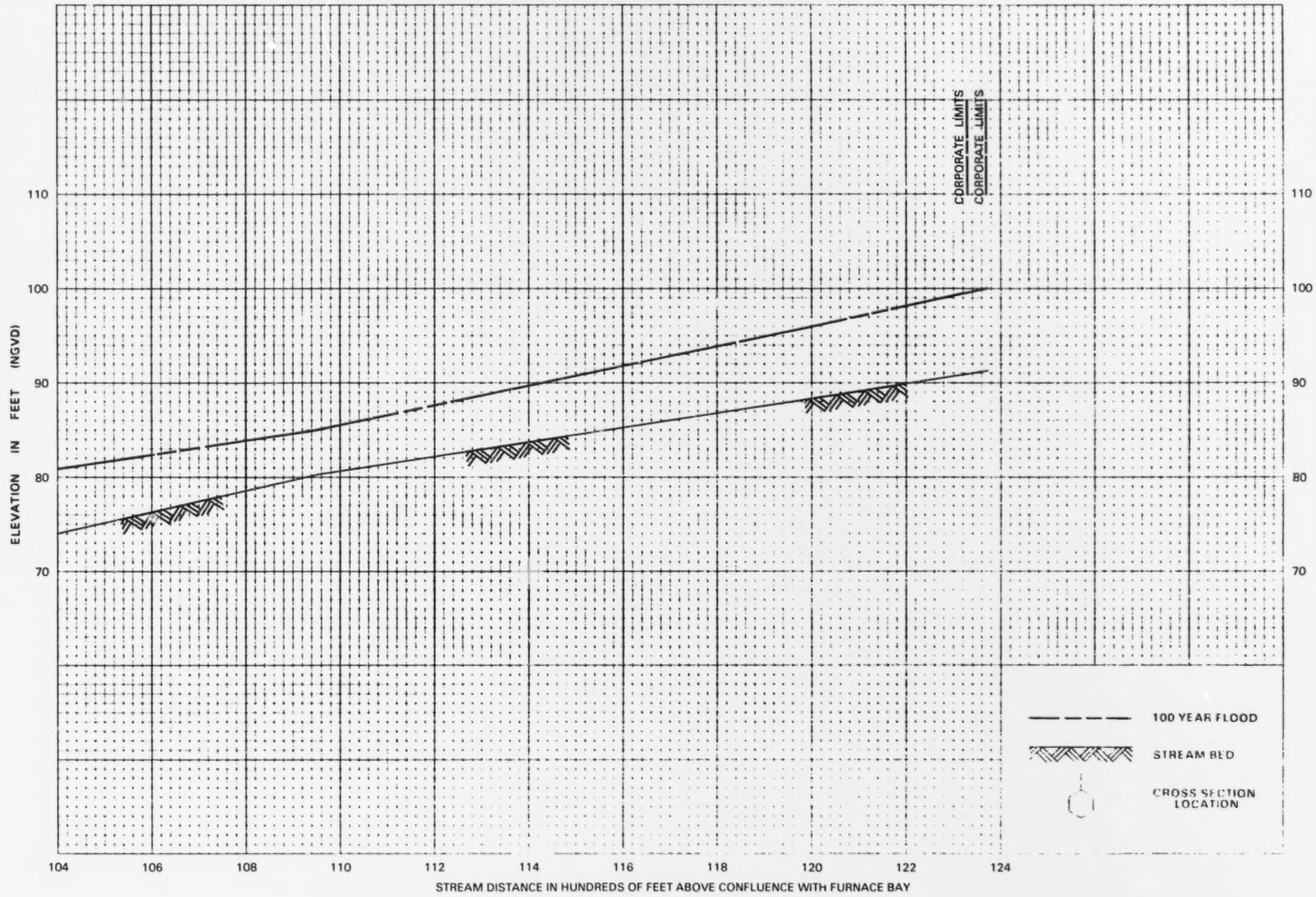
TOWN OF PERRYVILLE, MD
(CECIL CO.)

FLOOD PROFILES

MILL CREEK

06P

18



FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PERRYVILLE, MD

(CECIL CO.)

07P